

REMARKS

Introduction

Claims 1-36 are pending in the application. For the reasons discussed in detail below, all of the pending claims are in condition for allowance.

Prior Art Rejections

The Examiner has rejected all the claims under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 6,230,200 to Forecast et al ("Forecast"). Applicant respectfully traverses these rejections. In the following, applicant provides an overview of his invention and of Forecast and then discusses their differences.

Applicant's technique is generally directed to a system and method for enhancing file system performance by automatically balancing files among selected directories and by limiting the number of files in any directory. Certain file systems may experience degraded performance when more than a certain number of files are in the same directory. The balancing mechanism of applicant's invention operates to avoid such degraded performance. To this end, the balancing mechanism tracks the number of files in each directory (or cache directory) and determines whether more directories (or cache directories) need to be created. When one or more additional directories are needed, the balancing mechanism determines how many directories to create and creates that many directories.

Thus when new files are added, the balancing mechanism distributes the files among the various directories based on the directory that has the least number of files. If the number of files in the selected directory plus the number to be stored exceeds a predetermined threshold amount, then directories may be created. If no more directories may be created, then files may be removed from existing directories (such as those which have not been accessed for the longest time).

Note that the above description is for general informational purposes only, and is in no way intended to limit the claims, which are discussed below.

Forecast relates to a technique for allocating component resources for streaming data in a video file server. Forecast describes creating a dynamic model of the configuration of components for data handling in the video file server and allocating the components for routing of a video stream. The model includes assemblies and subassemblies in the video file server. The major subassemblies include a stream server, a cached disk array and a tape silo. The cached disk array includes micro-processor cards programmed to function as channel directors or disk directors. Each of the channel directors is interfaced through one of a number of SCSI adaptors to the SCSI interface of one of the stream servers. The channel directors access data in the cache memory in response to a request from its associated stream server. If data to be read by a channel director are not found in cache memory, the data is transferred from the disk array to the cache memory.

A controller of the file server has programs for automatically creating the dynamic model, modifying the dynamic model in response to component changes such as component failures, allocating component resources for routing of the video stream and balancing allocations of component resources to video streams. The dynamic model is created automatically by collecting information about what components are installed in the file server, the resources of the installed components, and connections between the installed components.

The dynamic model of Forecast is maintained in memory as a directed acyclic graph in which nodes represent the data handling components and edges represent data stream paths between the data handling components. The program for building the specific hardware configuration collects information about the components actually installed in the file server and determines the resources currently provided by each component. Each node and edge is then provided a list of component resources associated with the node or edge and current allocations of component resources to data streams and other tasks. An allocation program walks through the specific hardware configuration to optimally allocate available resources for handling a request to create a data stream and creates a list indicating a route through the file server for the data stream.

The allocation balancing program described in Forecast may free resources of a heavily loaded cached disk array including a file system containing a video stream for which a copy is stored in the file system in another cached disk array. In this case, the path of the existing stream of data from the heavily loaded cached disk array would be dynamically changed to originate from

the copy of the video stream in the other file server in order to free resources of the heavily loaded cached disk array.

Significantly, Forecast does not describe balancing files among directories, as claimed by applicant. Nor does Forecast describe distributing new files that are added among the various directories, as described in applicants' technique. Rather, Forecast describes allocating components in a video file server for streaming video data. In fact, Forecast expressly teaches away from load balancing files. In describing the components of the video file server, Forecast describes two physical file systems: a conventional UNIX File System and a Continuous Media File System (CMFS). The CMFS file system that is used for storing the video data streams may span several disks within a CMFS volume set. When a new CMFS file is created, it is written in a stripe across all the disks within the volume set. Forecast specifically states that "[t]he reason for multi-disk volume sets is to increase capacity rather than provide load balancing." Forecast then further explains that *load balancing for video streams may be accomplished by exporting multiple file systems.* (See Col 11:9-15).

Thus, Forecast teaches away from applicant's invention. Forecast's technique optimizes reading video content and does not load balance files among directories. Forecast teaches away from applicant's invention by striping across all disks within a volume set to increase capacity and suggests that load balancing of video content may be accomplished by exporting multiple file systems.

The following table lists the elements of claim 1 and the prior art sections upon which the Examiner has relied as allegedly disclosing those elements.

	Claim 1 Element	Prior Art
A.	providing at least two selected directories for storing files	Resources in a file server are allocated by dynamically modeling a configuration of data handling components in the file server and routing of data streams through the data handling components. ... Each node has a list of resources and current allocations of the resources.  (Forecast, Abstract :1-7)
B.	automatically balancing files among each of the selected directories.	The controller of the file server has programs for automatically creating the dynamic model, ... and balancing allocations of resources to data streams in order to free resources to allocate a path for a requested data stream.  Allocation balancing can free resources to enable routing of a stream that would otherwise be blocked. ...  (Forecast, Abstract :1-7; Col 67:40-47)

First, element A of claim 1 recites "providing at least two selected directories for storing files." The section of Forecast allegedly disclosing this element does not describe providing at least two selected directories for storing files. Rather, Forecast describes a directed acyclic graph in which nodes represent the data handling components of a video file server and edges represent video data stream paths between the data handling components. Each node of the graph has a list of resources and current allocations of the resources. Forecast does not describe directories as one of the resources listed or as one of the data handling components. Instead, Forecast describes the

resources as data handling components such as a stream server, a cached disk array and a tape silo. The cached disk array includes micro-processor cards programmed to function as channel directors or disk directors. Each of the channel directors is interfaced through one of a number of SCSI adaptors to the SCSI interface of one of the stream servers and may prefetch a track in the video stream and store it in the cache of the cached disk array. Nowhere in Forecast is there a description of directories included in the list of resources that are modeled and allocated.

Second, element B of claim 1 recites "automatically balancing files among each of the selected directories." Applicant's technique tracks the number of files in each directory and the balancing mechanism distributes the files among the various directories, e.g., based on the directory that has the least number of files. The sections of Forecast allegedly disclosing this element do not describe such a balancing technique. Rather, Forecast describes the resources as data handling components such as a stream server, a cached disk array and a tape silo. Forecast further describes allocating these components in a video file server for routing of the video stream. In describing the components of the video file server, Forecast describes two physical file systems: a conventional UNIX File System and a Continuous Media File System (CMFS) in which a file is striped across all the disks within the volume set. Forecast specifically states that "[t]he reason for multi-disk volume sets is to increase capacity rather than provide load balancing," and, thus to the extent Forecast can even be considered as dealing with storage, Forecast teaches away from applicant's invention.

Forecast further explains that load balancing for video streams may be accomplished by exporting multiple file systems, not balancing files among directories, as is done in applicant's technique. (See Col 11:9-15). The allocation balancing program in Forecast may free resources of a heavily loaded cached disk array including a file system containing a video stream. However, to do so, Forecast uses multiple file systems which contain copies of video streams and dynamically changes the path of an existing video stream from the heavily loaded cached disk array to originate from the copy of the video stream in another file server.

In summary, Forecast's technique optimizes reading video content and does not load balance files among directories. Forecast teaches away from applicant's invention by striping across all disks within a volume set to increase capacity and teaching that load balancing of video content may be accomplished by exporting multiple file systems, which is wholly unrelated to the invention as claimed.

Applicants respectfully submit that dependent claims 2-19, claims 20-35, and claim 36, by similar analysis, are not anticipated by Forecast. For example, dependent claims 2-19 also include the limitation of "automatically balancing files among each of the selected directories." As discussed above regarding claim 1, the sections of the relied-upon reference allegedly disclosing this element do not describe such a balancing technique. Claims 20-35 include the limitation of "a balancing mechanism configured to automatically create a selected directory in the file system for storing files, and further configured to distribute files from at

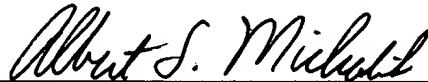
least one other directory in the file system to the selected directory." Forecast does not describe such a balancing mechanism. Instead, Forecast teaches away from applicant's technique, as discussed above. Finally, claim 36 is likewise not anticipated by Forecast. Claim 36 includes the limitation of a "second data field updated as files are moved among the plurality of directories." Nowhere in Forecast is there a description of updating a data field as files are moved among a plurality of directories.



**Conclusion**

Based upon the above remarks, all of the pending claims are in condition for allowance. Applicant respectfully requests reconsideration of this application and its early allowance. If in the opinion of the Examiner a telephone conference would expedite the prosecution of the subject application, the Examiner is invited to call the undersigned attorney at (425) 836-3030.

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**Certificate of Mailing**

I hereby certify that this Response and Petition for Extension of Time are being deposited with the United States Postal Service on the date shown below, with sufficient postage as first class mail, in an envelope addressed to: Commissioner for Patents, Alexandria, VA, 22313-1450.

Date: September 15, 2003

  
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Albert S. Michalik

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